# Derivation of Smooth Muscle Cells with Neural Crest Origin from Human Induced Pluripotent Stem Cells.

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**Public Summary:**
The heterogeneity of vascular smooth muscle cells (SMCs) is related to their different developmental origins such as the neural crest and mesoderm. From the perspective of regenerative medicine and tissue engineering, an expandable cell source of SMCs is required for the construction of tissue-engineered blood vessels. In this study, we developed a robust protocol to derive neural crest stem cells (NCSCs) from human embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs). NCSCs derived from both sources were expandable with similar cell doubling times. NCSCs were capable of differentiating into neural and mesenchymal lineages. TGF-beta1 induced the expression of SMC markers and resulted in the assembly of smooth muscle stress fibers. This work provides a basis for using iPSCs to study SMC biology and deriving vascular cells for tissue engineering.

**Scientific Abstract:**
The heterogeneity of vascular smooth muscle cells (SMCs) is related to their different developmental origins such as the neural crest and mesoderm. Derivation of SMCs from different origins will provide valuable in vitro models for the investigation of vascular development and diseases. From the perspective of regenerative medicine and tissue engineering, an expandable cell source of SMCs is required for the construction of tissue-engineered blood vessels. In this study, we developed a robust protocol to derive neural crest stem cells (NCSCs) from human embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs). NCSCs derived from ESCs and iPSCs were expandable with similar cell doubling times. NCSCs were capable of differentiating into neural and mesenchymal lineages. TGF-beta1 induced the expression of SMC markers calponin-1, SM22alpha, and smooth muscle myosin heavy chain and resulted in the assembly of smooth muscle alpha-actin, calponin-1, and SM22alpha into stress fibers. This work provides a basis for using iPSCs to study SMC biology and deriving vascular cells for tissue engineering.